

ARTICLES

The Impact of Disaster Education on Household Preparedness for Hurricane Hugo*

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This article examines the impact of disaster education on hurricane preparedness among residents in Charleston, South Carolina. The article examines (1) the impact of participation in disaster education programs generally; (2) the impact of hurricane experience as a type of education; and (3) the impact of participation in earthquake specific education programs to determine whether there is any transference of knowledge across agent types. Two indices of preparedness are used: household planning activities, and adaptive response activities. It was found that participation in some type of disaster education program is strongly related to the preparedness measures. Hurricane experience has some minimal effect on adaptive response but not on household planning. Participation in the earthquake specific education programs is not a significant predictor when controlling for other variables.

At about midnight Friday, September 22, 1989, six hours of the most destructive force South Carolina has experienced since the Charleston earthquake of 1886 smashed into the state with 135 mile per hour winds and a 12-20 foot surge of water. Billions of dollars of property damage were

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reported as a result of Hurricane Hugo, although only 28 deaths were reported state-wide in South Carolina. The small number of deaths for a storm of this magnitude is indicative of a most successful evacuation and other adaptive responses on the part of those residing in the path of the hurricane.

This study examines how individuals and households in the Charleston, South Carolina area prepared for and responded to Hurricane Hugo. Specifically, we seek to examine (1) the role of prior hurricane experience in preparedness and response; (2) the impact of disaster education generally on preparedness and response behavior; and (3) what impact, if any, earthquake specific education has on hurricane preparedness and response.

Disaster Preparedness

Preparedness is a concept used by researchers and practitioners to refer to a series of activities which directly or indirectly should mitigate loss of life and property in a disaster. Having a family disaster plan or establishing an evacuation route are examples of planning activities in which families or individuals might engage. Research assessing the extent to which individuals and households engage in pre-disaster planning reveals varying levels of preparedness. Hodler (1982), for example, found that 81 percent of the sample he studied had a family disaster plan and nearly all of these individuals responded according to their plan when a tornado struck Kalamazoo, Michigan. Perry and Lindell (1986) found slightly less, but still substantial levels of household planning for the Mt. St. Helens volcano with 69.9 and 48.8 percent of the individuals in their two sample communities indicating high levels of personal planning activity. Bourque et al. (1973), by contrast, found very few people who had made any preparations prior to the 1971 California earthquake. Similarly, Worth and McLuckie (1977) found that only three percent of their study population had developed any family disaster plans for Colorado floods in 1965.

Planning activities are usually distinguished from adaptive *response* which comprises protective behaviors in which individuals and households engage as a result of knowing that a disaster is impending. Hence, knowledgeable populations directly threatened with a hurricane remove loose items in their yards, fill their car with gas, store food and water, and make sure they have working flashlights and battery powered radios. These response activities are, of course, related to planning activities, and it is almost axiomatic that higher levels of preparedness should result in more appropriate response activities. Indeed, the one factor which Perry and his colleagues have consistently found to be related to favorable response to

impending disaster is prior planning and preparedness activities on the part of individuals and households (Perry 1979; Perry and Greene 1982, 1983; Perry et al. 1981).

In point of fact, of course, both planning and response activities are intended to reduce life and property loss. People who engage in either of these sets of activities are behaving in an adaptive manner to mitigate the threat to life and property. This is an important conceptual distinction, however, in that planning activities take place significantly prior to the disaster threat, whereas adaptive response activities typically occur after the threat has been established. Planning thus implies long term, on-going activities, whereas adaptive response suggests a more immediate response to a specific threat. Hence, we examine both types of behavior here independently as separate indicators of disaster preparedness.

The Impact of Disaster Education

Our concern in this study is the extent to which disaster education positively affects preparedness behavior. There is a noted paucity of literature on this subject. Saarinen (1982, p. 8) suggests that "except for communication research, the proposition that education may lead to more adaptive behavior has rarely been investigated." Numerous studies have found a positive relationship between adaptive response and disaster experience which is itself a type of education (Demerath 1957; Fritz 1961; Hutton 1976; Moore et al. 1963; Perry et al. 1981; Sorensen, 1983; Sorensen and White, 1980). There has, in addition, been an extended literature on the importance of disaster subcultures in facilitating appropriate preparedness behavior (Moore 1964; Weller and Wenger 1972; Wenger 1978). A major component of disaster subcultures presumed to facilitate preparedness and response is the increased level of knowledge on the part of individuals in these communities.

These studies raise important questions which we attempt to address in the present study. Prior disaster experience, particularly when it is of a repeated nature such as that found in disaster subcultures, certainly acts as a teacher of sorts in the school of hard knocks. This is perhaps the best school. But is it possible to learn the same lessons in a less costly manner, through participation in formal disaster education programs? Ideally, disaster education should provide participants greater knowledge of the threat itself, and of appropriate protective actions that can be taken. This knowledge should, in turn, result in appropriate adaptive behavior.

Our knowledge of the impact of disaster education on adaptive behavior is less clear than this ideal scenario would suggest, however. There is some

evidence to suggest that exposure to educational materials may increase knowledge and awareness of the threat (McKay, 1984; Ruch 1978; Ruch and Christensen, 1980; Waterstone 1978). Other research, however, has questioned how important disaster education programs are in informing one's knowledge and beliefs about disasters. Roder (1961) for example, found that the distribution of flood plain maps had no effect on citizen awareness of flood plain zones in Topeka, Kansas. Likewise, Haas and Trainer (1974) found no significant differences in knowledge regarding tsunamis following an educational program. Furthermore, Wenger et al. (1980) report that of those respondents who had received information from public education programs, only about one-third mentioned them as a source of information. Similarly, Sorensen (1983) found that most of his respondents did not regard educational information obtained through formal channels such as schools and brochures as very useful.

Moreover, even if disaster education programs are successful in enhancing knowledge and awareness, we can by no means assume that this knowledge will be translated into appropriate behavior. Social scientists have long recognized the disparity between cognitive and behavioral manifestations. That is, people do not always do what they say they will do (e.g., see Deutscher 1966; Freeman and Atav 1960; LaPierre 1934; Warriner 1958). More recently, O'Riordan (1976) found very little relationship between environmental attitudes and behavior. Hence, we cannot presume that even if people *know* what to do in a disaster that they will necessarily *act* on the basis of that knowledge.

There is some evidence, in fact, to suggest that they may. Drabek's (1986) exhaustive review has presented findings which suggest that the more information people have available to them, the greater will be the level of preparedness. These results obtained both in the United States (Perry and Greene 1982) and in Japan (Okabe 1979). Similarly, more impressionistic data from Regulski (1982) suggest that respondents receiving hurricane information kits from the Texas Insurance Information Center found this information helpful. Waterstone (1978) also found that respondents receiving brochures about flooding risks not only displayed a much higher level of flood awareness, but also engaged in more preparedness activity than those who did not.

Other research is less optimistic. Recent reviews of the literature by Sims and Baumann (1983) and by Sorensen and Mileti (1990) reveals that for any number of reasons, knowledge learned in disaster education programs does not always translate into appropriate behavior. Summarizing research conducted by Slovic et al. (1977), Saarinen (1982) suggests three

reasons why public education programs are not always effective in translating knowledge into adaptive behavior. First, people are resistant to change. Habits and perceptions, once formed, are not readily changed, even with exposure to new information. Second, making decisions that involve risk is not easy, and rather than cognitively engaging in these difficult processes, it is much easier to ignore the problem, hoping that it will go away. Finally, otherwise intelligent individuals are not always fully aware of the risks to which they are exposed. Good public education, of course, should address this deficiency if it exists. Moreover, it is not certain how long people will retain the information that they learn. Waterstone (1978) found that while those residents receiving educational material on floods were more highly aware of the threat than those who did not, within four to six weeks, only 62 percent even remember receiving it, and after a year, only 37 percent remember receiving this information.

There is, furthermore, a question as to whether knowledge accumulated for a response to one particular disaster agent will transfer to other agent types. Wenger (1978) suggests that knowledge gained from experience in one type of disaster may actually thwart response if an individual or community is confronted with a disaster which falls outside of their repertoire of experience. Sorensen and Mileti (1987, 1990) summarize their extensive review of the literature by noting that "the experience gained with one program at a single location...may not be useful in designing protective action schemes for different locations or for the entire country" (Sorensen and Mileti 1987:225). This research addresses this specific issue by examining how effectively earthquake education in the Charleston, South Carolina area transferred to appropriate preparedness activities for Hurricane Hugo. This educational information was specifically oriented to earthquake preparedness. While there is certainly overlap between the kinds of activities that these two types of agents require, earthquakes are substantially different from hurricanes in several respects. Hurricanes provide a long warning period; earthquakes provide almost no time. Many of the property protection measures such as securing lawn furniture, storing food and potable water etc. have less relevance for an earthquake than for a hurricane. This research, then, empirically examines not only the impact of disaster education generally on preparedness, but also how effectively education for one type of disaster (earthquakes) transfers to preparedness for other types of disasters (hurricanes).

Methodology

The study was conducted in February and March, 1990, some five months after Hurricane Hugo struck the Charleston area. The study population resides in Berkeley, Charleston, and Dorchester Counties, an area commonly referred to as the Charleston Trident Area. The most populous of the three counties is Charleston County with 307,348 people and host to the historic city of Charleston. The population of Berkeley and Dorchester Counties are 137,466 and 88,488 respectively. Racially, whites comprise 67.8 percent of the population and blacks 29.7 percent. Other nationalities make up the remaining 2.5 percent. The median income in the three county area is \$26,201, although Dorchester and Berkeley counties are somewhat more affluent than Charleston counties, each with a median income of more than \$28,000 (CICA Marketing Systems 1990).

The Samples

Two samples were drawn, representing two distinct populations. The first "workshop" sample consists of those individuals who participated in workshops sponsored by the Earthquake Education Center (EEC), a non-profit program which is partially funded by the federal government.¹ All participants whose phone numbers could be verified were included in this sample.² The final sample consists of 198 respondents, which, excluding bad (non-working or changed) numbers and unsuccessful attempts because the appropriate respondent would not be available during the fieldwork period, yielded a response rate of 73.1 percent.

The second, control sample draws from the general population of residents in the Greater Charleston area living in Charleston, Berkeley and Dorchester counties. The sample was selected by using the residential section of the white pages of area phone directories that included all three counties in a single listing. After randomly selecting a starting point for a systematic draw, every *n*th number was drawn. In order to insure an equal chance that households without listed numbers would be included, a "plus one" method was used whereby one digit was added to each number drawn from the phone directory. This technique has been found to increase the efficiency (proportion of good numbers to total numbers dialed) over random digit dialing by as much as 30 percent (Landon and Banks 1977), while at the same time guaranteeing an equal chance for unlisted numbers. The response rate for the control sample, after excluding business and non-working numbers, was 59.1 percent, yielding a total of 511 interviews.

Table 1 reports the demographic distributions of the samples as compared to the population characteristics of the three counties from which they were drawn. Comparing first the general sample with the population data reveals that the sample slightly overrepresents whites (79.1 percent versus 67.8 percent) and those in the middle to upper income ranges. Females are also substantially overrepresented in the general sample (62.2 percent versus 49.6 percent in the population). It is difficult to compare the level of education because the only population data available to us is the median number of years completed, which, for the three county area was 12.4 years. Our categorical data, however, suggests a median in the "some college" category, suggesting perhaps a slightly more educated general sample. Our sample was substantially older than the population median, but this is accounted for by the fact that we specifically targeted adults for our sample.

Comparing the workshop sample with the population estimates reveals that the workshop sample is almost exclusively white (94.4 percent) and has an even higher representation of females (76.8 percent). Significantly, the workshop sample is much more highly educated than the general sample (79.3 percent with college degree or higher, the median category being "graduate degree"). The workshop sample is also substantially more wealthy, with 87.3 percent of the sample having household incomes in excess of \$25,000. Only 51 percent of the households in the population were estimated to have this much income. Finally, the workshop sample is also slightly older even than the general sample (median age 42) and, comparing it to the general sample, more likely to be married (84.3 percent compared to 65.2 percent).

The greater representation of higher socioeconomic status individuals in the workshop sample is not surprising. It is typically higher educated, mid to high income range persons who are involved in the kind of organizations the Earthquake Education Center has reached. These differences do suggest, however, that disaster education initiatives such as the Earthquake Education Center need to be more consciously targeting lower income, minority families, as well as younger and single individuals who may not be reached through these traditional channels.

Dependent Variables: Hurricane Preparedness and Response

The dependent variables analyzed in this study consist of two indices constructed from 12 preparedness items from the survey. Principal axis factoring techniques were employed in order to examine the interrelationships among these variables, and more specifically to determine if these variables could be scaled (Kim and Mueller 1978a). Items with factor

Table 1. Demographic Characteristics of Samples Compared with General Population

	Population (Percent)	Workshop (N = 198)		General (N = 511)	
		N	%	N	%
Median Age*	30	42		39	
Ethnicity*					
White	67.8	187	94.4	404	79.1
Black	29.7	9	4.5	93	18.2
Other	2.5	2	1.0	14	2.8
Education*					
Less than HS		1	.5	72	14.1
HS or GED		18	9.1	137	26.8
Some College		22	11.2	152	29.7
Col. Degree		53	26.8	84	16.4
Grad. Degree		104	52.5	66	12.9
Median:	12.4 Years	Grad. Degree		Some College	
Marital Status					
Single	No Data	16	8.1	89	17.4
Married		167	84.3	333	65.2
Div/Sep		12	6.1	51	10.0
Widowed		3	1.5	38	7.4
County of Residence*					
Charleston	57.6	70	35.4	306	59.9
Berkeley	25.8	68	34.3	121	23.7
Dorchester	16.6	60	30.3	83	16.2
(No Data)		—	—	(1)	(.2)
Household Income*					
LT \$15,000	26.9	2	1.0	79	12.5
15-25,000	20.9	16	8.1	116	22.7
25-35,000	17.5	42	21.2	108	21.1
35-50,000	18.9	67	33.8	100	19.6
GT 50,000	14.6	64	32.3	86	16.9
(No Response)		(7)	(3.5)	(22)	(4.3)
Sex**					
Male	50.4	46	23.2	189	37.0
Female	49.6	152	76.8	318	62.2
(No data)		—	—	(4)	(.8)

*Population data for these items obtained from 1990 estimates published in CICA Marketing Systems, *The Sourcebook of County Demographics*, 1990.

**Population data for this item obtained from the Division of Research and Statistical Services, State Data Center, Columbia, South Carolina, 1988.

loadings failing to exceed .30 for any given factor were dropped from the analysis (Kim and Mueller 1978b). This procedure yielded two factors which were used as the basis for the construction of our indices. For both factors, individual items, which were dichotomously coded (1 = yes; 0 = no), were summated to form the index. The first index, Household Planning ($\alpha = .544$), is made up of four items from the survey which measure longer term planning activities in which households might engage to prepare for the threat of a hurricane. These activities, which are detailed in Table 2, include having family meetings, having a plan for what to do if the family is separated, identifying a safe spot in one's home, and establishing an evacuation route. The values for the Household Planning Index range from 0 to 4, with low values indicating low planning and high values indicating high levels of planning.

Table 2. Construction of Variables Used in Analyses

Variable	Items Used in Constructing Variable
Household Planning	<ol style="list-style-type: none"> 1. Did you have family meetings to establish emergency procedures? 2. Did you have a safe spot identified in your home? 3. Did you have an established evacuation route? 4. Did you have a plan for what to do if your family was separated at the time the hurricane struck?
Adaptive Response	<ol style="list-style-type: none"> 1. Did you have a battery-powered radio? 2. Did you have adequate water stored? 3. Did you have a working flashlight? 4. Did you have a first aid kit? 5. Did you secure items in your yard? 6. Did you have a supply of non-perishable food? 7. Did you have extra batteries on hand? 8. Did you have a full tank of gas in your car?
Other Disaster Education	<ol style="list-style-type: none"> 1. Have you ever attended a disaster workshop in your community? 2. Have you ever attended an in-service workshop at work? 3. Have you ever attended a disaster presentation in high school or college classes? 4. Has any adult in your household ever attended a disaster workshop in your community? 5. Has any adult in your household ever attended an in-service workshop at work? 6. Has any adult in your house ever attended a disaster presentation in high school or college classes?
Hurricane Experience	<ol style="list-style-type: none"> 1. Have you ever been in a hurricane before? 2. Has anyone in your household ever been in a hurricane?

Adaptive Response ($\alpha = .576$), our second index, consists of eight items which measure activities usually undertaken upon hearing of a specific hurricane threat. These items, which are also detailed in Table 2, include having a battery powered radio, a working flashlight, a first aid kit, a supply of nonperishable food, securing loose items in one's yard, having adequate water stored and having a full tank of gas. The values for this index range from 0 to 8, with low scores corresponding to a low adaptive response and high scores indicating a high adaptive response.

Independent and Control Variables

A series of independent and control variables are also employed in this study. While we are interested in whether workshop participation might account for higher levels of household planning and/or adaptive response, it is conceivable and perhaps even likely that respondents in both of our samples may have received prior disaster education from sources other than the Earthquake Education Center. Because of this possibility we employ a dummy-coded variable, Other Disaster Education, which indicates whether or not the respondent or anyone in their household has participated in any other type of disaster education program (see Table 2 for the specific questions used to construct this variable). If any member of the respondent's household had participated in any other type of disaster education program, Other Disaster Education was coded as a "1"; if not, this variable was coded "0."

In addition to disaster education, prior disaster experience has been shown in the literature to be a powerful predictor of preparedness (e.g., Demerath 1957; Fritz 1961; Hutton 1976; Moore et al. 1963; Perry et al. 1981). Hence, we have included a second independent variable, Hurricane Experience, which measures whether the respondent, or anyone in his or her household had ever been in a hurricane prior to Hugo.³ This variable is also dummy-coded with those households having had prior hurricane experience coded as "1," and those without any prior hurricane experience receiving a value of "0." (See Table 2 for specific questions comprising this measure.)

Six demographic variables are also included in the analysis. Income and educational levels have both been found to be related to disaster knowledge and adaptive response to disasters (e.g. Bourque et al. 1973; Mack and Baker 1961; Moore et al. 1963; Neal et al. 1982; Palm 1981), although some research has suggested that levels of formal education is not that important (Burton et al. 1978; Baker 1979). These variables are coded in the following manner: Income (1 = less than \$15,000; 2 = \$15,000-\$25,000; 3 = \$25,000-

\$35,000; 4 = \$35,000-\$50,000; 5 = \$50,000-\$100,000; 6 = greater than \$100,000); Education (1 = 8th grade or less; 2 = some high school; 3 = high school or equivalent; 4 = some college; 5 = four year college degree; 6 = graduate work or graduate degree).

The other demographic variables controlled for include Race (1 = white; 2 = other); Home Ownership (1 = owns home; 2 = does not own home); Dependents (measured directly as the number of dependents living in respondent's home); and Marital Status (1 = married; 2 = not married). These are all variables which might be expected to affect preparedness behavior. Prior research has suggested a relationship between race and adaptive response behavior, particularly evacuation (Drabek and Boggs 1968; Perry et al. 1981, 1982; Lindell and Perry 1992). Home ownership, marital status and the number of dependents in a household all suggest some level of social integration, thereby increasing the likelihood of protective behaviors.

Method of Analysis

Because our two samples are estimates of distinct populations (i.e., workshop participants and the general population), we have kept them separated for analytical purposes. As such, the primary nature of our analysis is comparative, focusing on any differences that might exist between the two samples in preparedness behaviors. However, we are also interested in the relative contribution of disaster education and prior hurricane experience to both household planning and response. Therefore, separate techniques are employed to address each of these research questions. Comparisons between the two samples regarding household planning and response are made using appropriate forms of the t-test. Because we are interested in examining the linear relationship between our dependent and independent measures, OLS regression techniques are used to assess the relative effect of other disaster education and prior hurricane experience on preparedness and adaptive response. Given the continuous nature of our dependent variables, and evidence that the error terms are normally distributed, these techniques seem most appropriate for our analysis.

Findings

Comparisons between the two samples for purposes of examining the impact of earthquake specific education on household planning and adaptive response are made by employing a t-test to determine if the mean values of that variable were significantly different in the two samples.⁴

Earthquake Education and Household Planning

The mean scores on the preparedness index for the workshop sample ($\bar{X}_w = 2.285$) is significantly greater than that of the control sample ($\bar{X}_c = 2.203$; $t = 2.920$, $p < .05$ for a one-tailed test of significance). This would suggest that workshop participation did indeed have an effect on household planning. However, when control variables are employed, this t -value drops precipitously ($t = -.048$, n.s.), with no significant differences existing between the two samples.⁵ This indicates that initial differences between the samples regarding hurricane preparedness are in fact spurious, resulting from the influence of the control variables.

Earthquake Education and Adaptive Response

The same procedure is repeated for adaptive response and as with preparedness, the initial comparison for the response variable indicates a significantly higher score for the workshop sample ($\bar{X}_w = 7.411$; $\bar{X}_c = 6.961$; $t = 6.70$, $p < .05$). Again, however, this significant difference disappears when control variables are employed ($t = 1.095$, n.s.).

For both household planning and adaptive response, therefore, the apparent effect of workshop participation on preparedness seems to be primarily a manifestation of the demographic nature of the workshop sample. As revealed in Table 1, this sample was much more highly educated, and of a higher socioeconomic status than the general sample, both factors which likely account for much of the initial differences between the two samples.

The Impact of Other Disaster Education and Prior Hurricane Experience

In addition to the earthquake-specific education programs, we are interested in the more general role of disaster education and prior disaster experience in facilitating higher levels of preparedness. These results are reported for household planning and adaptive response in Tables 3 and 4 respectively.

Household Planning. Table 3 presents the results of the regression analysis for household planning for each sample. As this table reveals, only prior disaster education significantly predicted preparedness ($b = .622$, $\beta = .225$, $p < .01$). No other variable, including prior hurricane experience, approached statistical significance. The slope coefficient indicates that the existence of prior disaster education results in more than a 12% increase in

hurricane preparedness (.622 units). The overall explanatory power of the model, however, is relatively weak, explaining only 9% of the variation ($R^2 = .092$).

The results for the general sample, also presented in Table 3, show a similar pattern to the workshop sample. Again, other disaster education is statistically significant ($b = .510$, $\beta = .214$, $p < .001$), accounting for slightly more than a 10% increase in preparedness. Prior hurricane experience fails to attain significance for the general sample as it did for the workshop sample. Unlike the workshop sample, however, the number of dependents in a household is significant ($b = .163$, $\beta = .193$, $p < .001$). Nonetheless, similar to the workshop sample, the model accounts for only 8% of the total variation in preparedness ($R^2 = .081$).

Adaptive Response. The results of the regression analysis for adaptive response is revealed in Table 4. As in the previous models, prior disaster education is the single best predictor ($b = .461$, $\beta = .218$, $p < .01$) for adaptive response for the workshop sample. Additionally, race is statistically significant ($b = .567$, $\beta = .143$, $p < .05$). Once again, hurricane experience does not significantly impact on adaptive response for the workshop sample. Like the household planning models, the explanatory power of the model for this index, is only marginally improved, accounting for slightly under 11% of the variation in adaptive response ($R^2 = .109$).

Table 3. Regression Analysis of Household Planning Index on Disaster Education, Hurricane Experience, and Control Variables

Variable	Workshop Sample			General Sample		
	b	β	SE	b	β	SE
Other Disaster Educ.	.622 ^b	.225	.201	.510 ^a	.214	.117
Hurricane Experience	.277	.093	.217	-.003	-.001	.116
Marital Status	-.244	-.069	.303	-.157	-.060	.139
Race	-.029	-.005	.399	.001	.001	.145
Education	.099	.083	.090	-.007	-.007	.048
Number of Dependents	.043	.046	.070	.163 ^a	.193	.042
Income	.018	.021	.072	.012	.018	.035
Home Ownership	-.453	-.110	.326	-.069	-.028	.127
	$R^2 = .092$ $F = 2.245^c$			$R^2 = .081$ $F = 4.654^a$		

^a $p < .001$

^b $p < .01$

^c $p < .05$

Table 4. Regression Analysis of Adaptive Response Index on Disaster Education, Hurricane Experience, and Control Variables

Variable	Workshop Sample			General Sample		
	b	β	SE	b	β	SE
Other Disaster Educ.	.461 ^b	.218	.150	.543 ^a	.199	.132
Hurricane Experience	-.092	-.040	.165	.341 ^c	.122	.132
Marital Status	.245	.097	.218	.113	.038	.159
Race	.567 ^c	.143	.287	.664 ^a	.185	.175
Education	-.025	-.028	.067	.008	.008	.053
Number of Dependents	.064	.090	.052	.046	.048	.049
Income	.048	.071	.053	.041	.052	.049
Home Ownership	-.278	-.088	.246	.321 ^c	.109	.145
	$R^2 = .109$ $F = 2.777^b$			$R^2 = .144$ $F = 8.536^a$		

^a $p < .001$

^b $p < .01$

^c $p < .05$

The results for adaptive response in the general sample, also presented in Table 4, show a slightly different pattern than that for the workshop sample. While disaster education ($b = .543$, $\beta = .199$, $p < .001$), and race ($b = .663$, $\beta = .185$, $p < .001$) are again significant predictors of adaptive response, prior hurricane experience ($b = .341$, $\beta = .122$, $p < .05$) and home ownership ($b = .321$, $\beta = .109$, $p < .05$) are also significant here. Not surprisingly, the explanatory power of the model increases, although only slightly ($R^2 = .144$).

Discussion

We began this paper by proposing to examine the impact of disaster education on hurricane preparedness, and more specifically, the impact of earthquake education on hurricane preparedness. In addition, because disaster experience is itself an educational experience, we examined its impact on planning and response. The findings are quite clear as to the effect of disaster education generally. Disaster education is the most powerful predictor in three of the models, and closely follows race in explanatory power for the last model. This single variable accounts for most of the explained variance in the household planning and the adaptive response models for both samples. These data thus lend firm support to earlier studies such as those of Regulski (1982), Ruch (1978) and Waterstone (1978) which found

that availability of educational materials did indeed positively impact preparedness activities.

The impact of earthquake education specifically, however, is not significant for either planning or response. The weak impact of workshop participation on preparedness activity may be due in part to the fact that EEC workshops tend to reach households which participate in other disaster education programs anyway. Table 1 reveals that the workshop sample is almost exclusively white, and at the higher ends of the income and educational spectra, that segment of the population which is more likely to take advantage of educational opportunities. Indeed, more than 73 percent of the respondents in the workshop sample indicated that they have participated in other disaster education programs. Hence, when controlling for other disaster education, which we did in the t-tests, workshop participation will not be a powerful predictor. The demographic profile of the workshop sample provided in Table 1 suggests that disaster education programs such as the EEC need to target lower income, minority populations which are not only less likely to have had other disaster education opportunities, but which are more vulnerable to the devastating effects of many disasters.

Prior hurricane experience, the third independent variable examined, is significant only for adaptive response among the general sample. This finding is generally consistent with decades of prior disaster studies cited earlier, finding a relationship between prior experience and response. Its impact on longer term planning activities, however, is minimal.

As expected, the variables related to social integration (having dependents, and home ownership) remained in one or more of the models as significant predictors of mitigative behavior. Consistent with the findings of earlier studies (Drabek and Boggs 1968; Perry et al. 1981, 1982; Lindell and Perry 1992), race was also found to be significantly related to adaptive response for the general sample, with whites more likely to take such behaviors than blacks and other minorities. Contrary to much of the earlier literature, however, which finds a significant relationship between education and income and adaptive response (Bourque et al. 1973; Mack and Baker 1961; Moore et al. 1963; Neal et al. 1982) these were not important factors in the preparedness activities of residents in the Charleston area.

In sum, our data suggest that the earthquake education workshops did not contribute to the general level of preparedness among the respondents we interviewed, controlling for other relevant variables. These data clearly point to the need to target low income and minority populations in future education efforts. The more important finding, however, is the important role that disaster education generally plays in enhancing levels of prepar-

edness. This was the most powerful predictor in the model. Even so, the contribution of the general disaster education variable in substantive terms was only about one-half to two-thirds of a preparedness/response item. That is, those individuals who had participated in disaster education programs scored a half to two-thirds of a point higher on the planning and response indices than those who had no prior disaster education. Given the significance of a disaster education relative to other variables, these data suggest that such education efforts are worthwhile, and should be continued. They are more than anything else we have going. At the same time, the limited substantive contribution of the education variable suggests a need for improving the content and process of these educational efforts.

Notes

1. The Earthquake Education Center (EEC), based at the Baptist College at Charleston, was established in 1983 with funding from the Federal Emergency Management Agency (FEMA), and since that time has sponsored over 500 programs reaching some 40,000 individuals. Additionally, the Center has distributed over 100,000 brochures and responded to thousands of requests for information by phone and mail.

2. Since we sampled the entire population of workshop participants whose phone numbers could be identified, the workshop respondents technically constitute a population of available EEC participants.

3. We also used disaster experience generally (not specifying hurricane experience specifically) in early analyses. The effects of this variable in the regression model were identical to that of hurricane experience. Hence, we are reporting only the effects of hurricane experience, the more specific of the two measures.

4. More complete tabular information for the t-tests as well as correlation matrices for the variables used can be obtained by writing to the senior author.

5. This comparison was achieved by regressing hurricane preparedness on the independent and control variables. Because the intercept term (the constant) represents the value of the dependent variable controlling for the independent and control variables, that term could be used for such a comparison. A test for parallelism of slopes, an alternative form of the t-test, was employed to derive the t-value (Kleinbaum et al. 1988). Additional information on this technique as well as relevant statistics can be obtained by writing the senior author.

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